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요 약

우리나라 근해의 요각류 군집을 파악하기 위한 연구 수행중에 동지나해와 우리나라의 동해안에서 부유성 요각류인 *Paracalanus gracilis* 가 출현 하였다. Chen 과 Zhang (1965)이 최초로 기재한 이후에 *P. gracilis* 는 전 세계의 어느해역에서도 보고된 바가 없다. 이에, 한반도 근해에서 본 종의 출현을 보고하고 기재를 한다.

Key words: Plankton, Copepoda, Calanoida, Taxonomy, *Paracalanus gracilis*

INTRODUCTION

Paracalanids are dominant component which comprises of about 20 species from world ocean, sometimes consisting in 80% of marine copepods abundance. Most of them are neritic and very abundant in coastal waters. They play an important role as primary consumer in marine ecosystem. Several studies on the distribution and species composition of paracalanid copepods had been reported in the nearshore and coastal waters of Korea. *Paracalanus parvus* and *P. aculeatus* was

reported by Park (1956) from off Pusan and *P. crassistris* was known by Kim & Hue(1983) in Karolim Bay and this three species was described by Kim (1985). Also, *P. indicus* was reported in Chunsu Bay (Shim & Yun, 1990). As a result, four species of the genus *Paracalanus* has so far been reported from Korean waters.

But, this genus had been considered some taxonomical problems of which Tanaka (1956) divided *Paracalanus parvus* to forma major and minor in coastal waters of Japan and Bowman (1971) reexamined *P. parvus* to *P. indicus* and

P. quasimodo in northwestern atlantic ocean.

Except the first report by Chen & Zhang (1965), *Paracalanus gracilis* was not yet reported in the world ocean. This copepod was known to habit in subtropical waters, i.e. East China Sea, by its first record.

Since the first description of *Paracalanus gracilis* is without complete figures and body ratio was not distinct, the fine description of *P. gracilis* is very important.

MATERIALS AND METHODS

Zooplankton samples were collected from ten stations off the Korean peninsula by using of the plankton net (Table 1, Fig. 1). Samples were fixed with 5% neutralized formalin on board. The period of samplings was between April 1985 and January 1993. Copepods were sorted from each sample under the dissecting microscope. Then, they were soaked in lactic acids for identification and measurement. The drawing was made with an aid of the camera lucida. All appendages were dissected and mounted in Polyvinylalcohol.

Table 1. The sampling stations

Stations	Periods	Remarks
1. Near Cheju	Nov., 1986	
2. "	Feb., 1988	
3. Kwanyang Bay	Jan. 1991 - Dec. 1992	Seasonally
4. Kori	Nov. 1990 - Feb. 1992	"
5. Wolsung	Nov. 1990 - Feb. 1992	"
6. Uljin	Oct. 1990 - Mar. 1992	"
7. Masan Bay	April 1985 - Sep. 1986	Monthly
8. Kyonggi Bay	Oct. 1990 - Sep. 199	"
9. Shiwha	Mar. 1992 - Jan. 1993	Seasonally
10. Youngkwang	Nov. 1990 - Feb. 1992	"

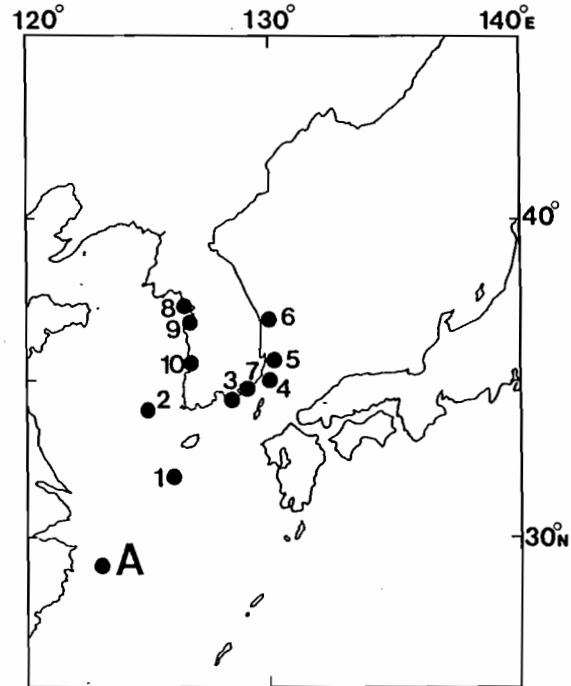


Fig. 1. The sampling stations (A represents type locality of *Paracalanus gracilis*).

DESCRIPTION

with 1 curved setae on internal margin. Basis with 1 seta on internal margin. Setal formula same as the followings:

Exp 1 2 3 Enp 1 2
1-1 ; 0-1 ; III-3-1 0-1 ; 2-2

Outer spine of first exopodal segment very small and short.

Setal formula of other legs (Figs. 3, a - c) same as followings:

	Exopod	Endopod
Leg 2	I-1 ; I-1 ; II-I-4	0-1 ; 0-2 ; 2-2-3
Leg 3	I-1 ; I-1 ; II-I-5	0-1 ; 0-2 ; 2-2-3
Leg 4	I-1 ; I-1 ; II-I-5	0-1 ; 0-2 ; 2-2-3

Number of tooth-shaped spinules on outer margin of third exopodal segment 6, 9, 8 in orders. Coxa

with 1 seta, however, basis without seta. Leg 5 (Fig. 3d) has 2 segment. Anterior margin of distal segment with 2 apical spines. Inner apical spine longer than outer one. Second segment of right leg 5 slightly longer than second segment of left leg.

Male: Unknown

Remarks: Present specimens are slightly different from the description by Chen & Zhang(1965). First, outer margins are not denticulated on inner apical spine of thoracic leg 5. Second, the ratio of prosome and urosome and the length ratio among urosome segments are different from those of original description. Third, the ratio of the length and the width of furcal ramus are different, respectively. Except for these differences, present specimen showed identical characters with the original description. And the second and the third problems of the differences between present specimen and Chen & Zhang's are not important, since it is able to rise by the manner of measurement and preservation. Otherwise, the first case is very difficult to ignore, however, the individual variations are to find easily in calanoid copepods (Chen & Zhang, 1965; Brylinski, 1984). On the contrary, the length of the 23th segment of antennule and the body ratio of width and length are more important characters in *Paracalanus gracilis*. The measurements and figures of these characters in the original description are very similar to the results of present study.

Distribution: *Paracalanus garacilis* first occurred in the East China Sea(28°N, 123° E). In present study, *P. gracilis* distributed in six stations might affected by warm water currents. Also, the occurrence of *P. gracilis* limited in Autumn and Winter (Table 2). The peroid of occurrence of *P. gracilis* is from September to February. *P. gracilis* does not occurred during the period between March and August at all, that is accord with the reducing of affection of warm water currents in this study

area.

Table 2. Occurrence periods of *Paracalanus gracilis* in study area

Season St.	1986 Nov.	1988 Feb.	1990 AJSN	1991 AJSN	1992 AJSN
1	M	L			
2	M				
3				R	
4			R		RR
5			L		RR
6			R	RR	
7					
8					
9					
10					

M : more than 1,000 indiv./m³

L : more than 100 indiv./m³

R : rare, less than 100 indiv./m³

Generally, paracalanid copepods are very important in abundance of coastal zooplankton community. It is revealed in present study that *Paracalanus gracilis* also play a important role of the zooplankton community off the Korean Peninsula, especially, in the winter. *P. gracilis* distributed at six station in the south and east coast of Korean Peninsula. But *Paracalanus garacilis* Chen & Zhang, 1965

Figs. 2 - 3

Paracalanus garacilis, Chen & Zhang, 1965, p. 42, pl. 9, Figs. 13-15.

Material examined: For measurement, 5 ♀♀, St. 1, November 11, 1986; 2 ♀♀, St. 2, February 11, 1988; 2 ♀♀, St. 3, December 14, 1992; 2 ♀♀, St. 4 November, 1992; 3 ♀♀, St. 5, November, 1990; For description, 2 ♀♀, St. 6, October, 1990.

Female; Body length 0.85 mm (range 0.80-0.90 mm, based on 16 indivs.), greatest length of cephalothorax 0.19 mm. Body (Fig. 2, a, b) slender, head narrowly rounded. First thorax segment fused with head and 4th segment with 5th segment. Ratio of prosome and urosome 78 : 22. Ratio of each

cephalothorax segment same as followings:

$$\begin{array}{ccccccc} \text{Head + Th1} & : & \text{Th2} & : & \text{Th3} & : & \text{Th4 + Th5} \\ 50 & : & 15 & : & 15 & : & 20 & = & 100 \end{array}$$

Posterodistal margin of last segment of thorax rounded. Genital segment longer than width dorsally. Ratio of each urosome segment same as followings:

$$\begin{array}{ccccccc} \text{Ur1} & : & \text{Ur2} & : & \text{Ur 3} & : & \text{Anal Seg.} & : & \text{Furcal ramus} \\ 39 & : & 11 & : & 11 & : & 21 & : & 18 & = & 100 \end{array}$$

Furcal ramus (Fig. 2, c) longer than width, 2:1 with 1 lateral seta and 4 terminal setae. Each terminal setae ornamented with fine setules. second seta from internal end longest. Length of these setae 250, 270, 240 and 140 μm , respectively. Length of 1 lateral seta 40 μm .

Antennule (Fig. 2, d) 24-segmented, and longer than body beyond 2 and half segment long. First and 23th segments longer than others. Segments from 8th to 20th with 1 row of spinules, respectively. 23th segment with 2 aesthetask and 2 setae. Last segment very small. Endopod of antennae (Fig. 2, e) shorter than exopod.

Leg 1 (Fig. 1, f) consists of 2 segment of endopod and 3 segment of exopod. Coxa of leg 1 *P. gracilis* did not occur in Masan Bay which is semienclosed and does not affected by open ocean. *P. gracilis* did not occur, also, in other three stations of the west coast of Korean Peninsula. It is a general facts that there are distributed few oceanic species but mainly neritic species in Yellow Sea. Therefore, *P. gracilis* is not a inhabiting species near Korean Peninsula and maybe a traveler from south warm waters with the warm water currents.

Especially, it is very important that the occurrence of *P. gracilis* is consistent with the increasing in affection of warm water currents. Also, it is accord with the occurrence of chaetognath, *Sagitta enflata* which is a indicator species of Kuroshio currents in the previous reports (Park, 1970).

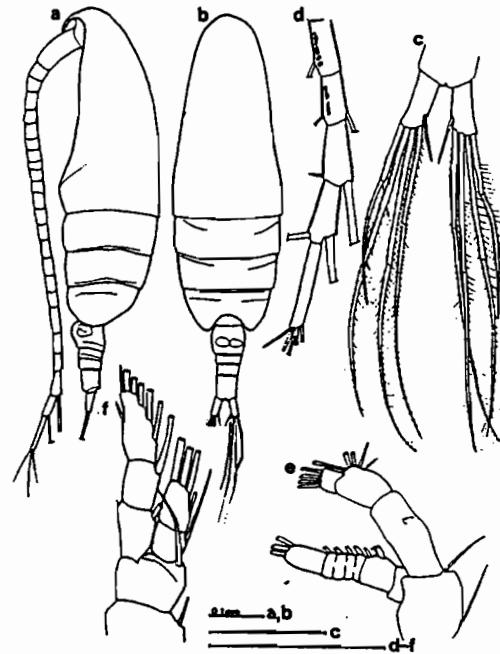


Fig. 2. *Paracalanus gracilis*, female, a. lateral view; b. dorsal view; c. furcal rami; d. terminal region of the antennule; e. antennae; f. leg1.

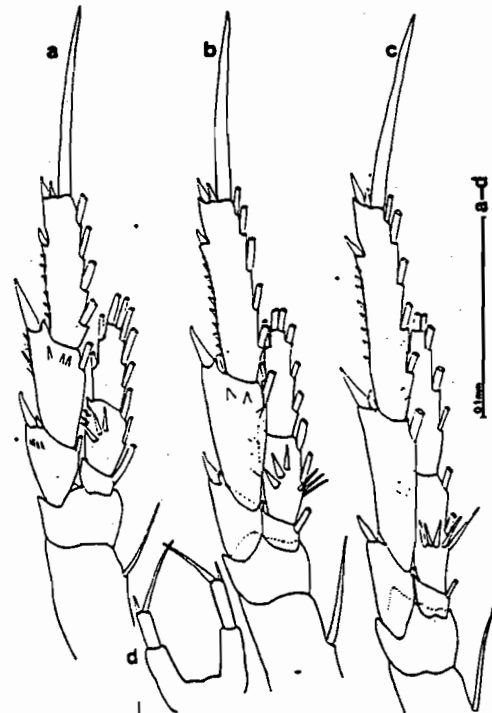


Fig. 3. *Paracalanus gracilis*, female, a. leg 2; b. leg 3; c. leg 4; d. leg 5.

SUMMARY

During the survey of the copepod community in Korean waters, *Paracalanus gracilis*, a planktonic calanoid copepod, appeared to near the East China Sea and off the East coast of Korea. *P. gracilis* not reported from the world ocean, except the first record by Chen & Zhang(1965). Authors report the occurrence of this species in the neighbouring waters of Korean Peninsula and describe it.

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